PHX Arrivals – An Optimized Point of View

EWG Meeting

November 17, 2008

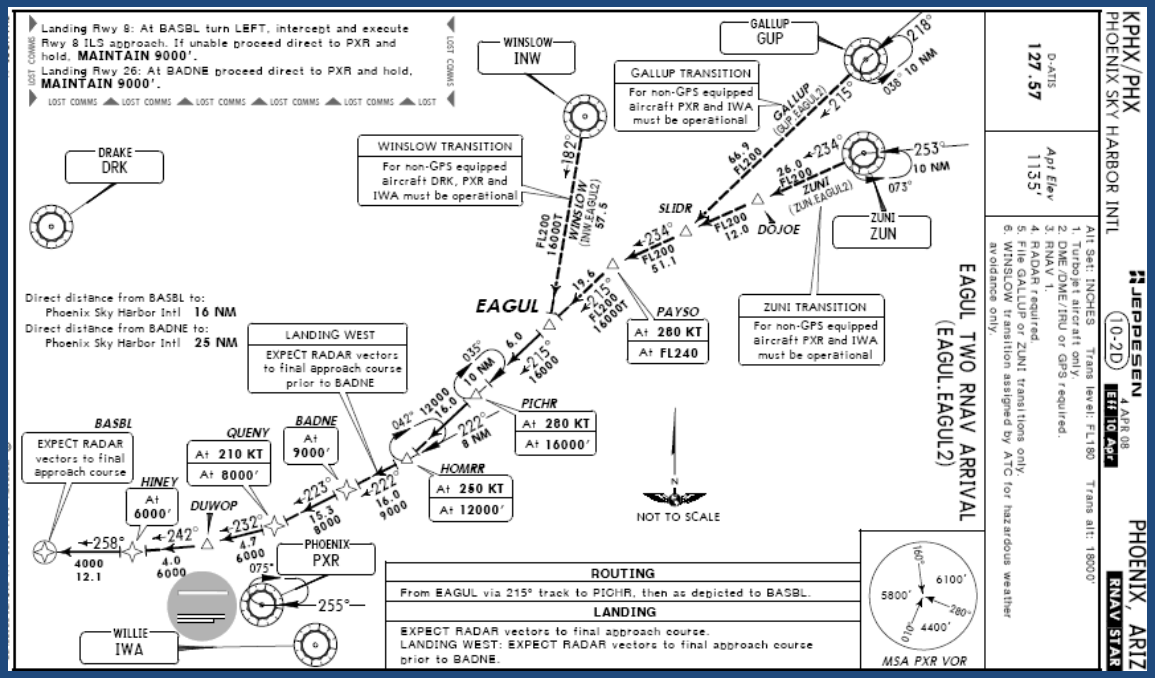
Captain Brian Townsend US Airways

Air Traffic and Customer Approach

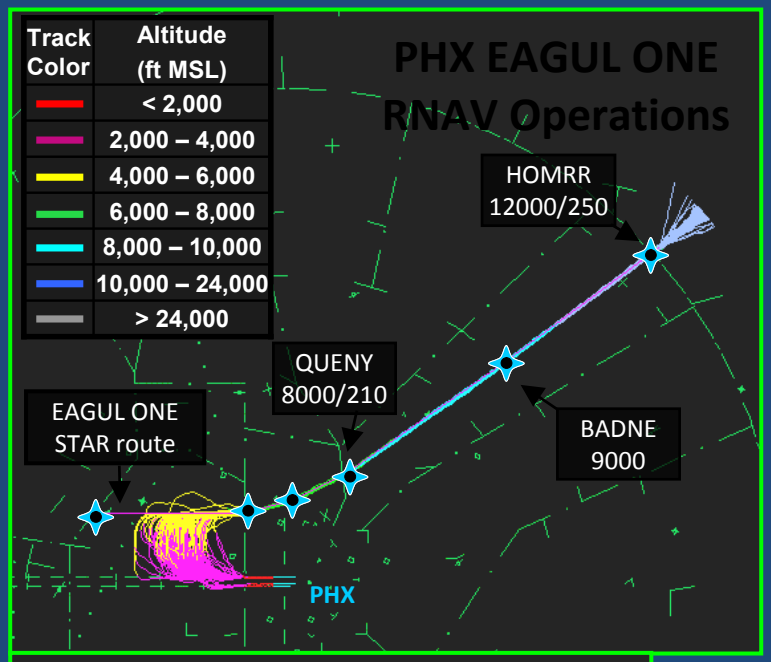
- Willing to listen to customer needs and make necessary operational changes
- Created RNAV procedures that provide tangible benefits from initial design to implementation
- Worked within the existing airspace confines
- Continuing to find ways to build from the foundation for added value

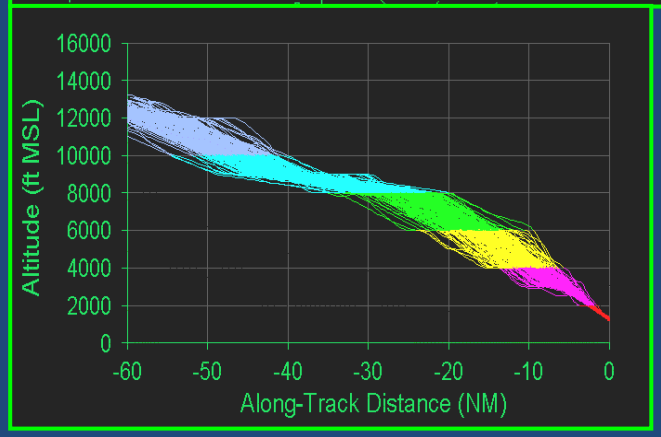
PHX RNAV STARs

- STARs implemented in October 2006
- All with published altitudes and speeds in the en route portion
- Descend Via was a huge change for TRACON and En Route Controllers
- Operational challenges and philosophies restricted vertical profiles to the terminal environment



PHX EAGUL RNAV STAR Terminal Area Benefits





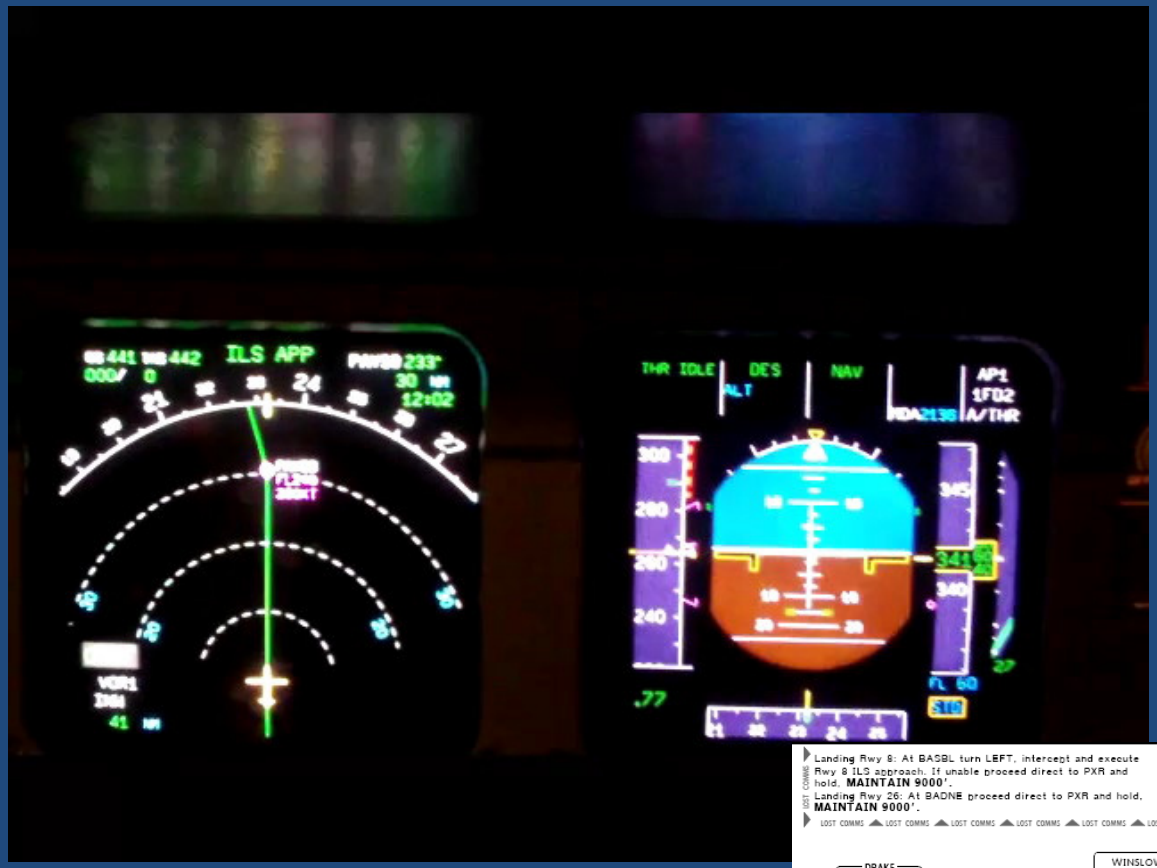
- **PHX RNAV procedures with vertical guidance and descend via**
  - Reduce low-altitude level flight segments
  - Enable more time in reduced or idle-power descent
- **Fuel burn savings to operators**
  - Observed savings of 5 gallons per flight
  - Savings of up to 9 gallons per flight possible with full equipage and participation
- **Lower aircraft emissions**
  - Observed savings of 2500 Metrics tons of Carbon Dioxide (CO_2) per year
  - Savings of up to 4500 metric tons per year possible

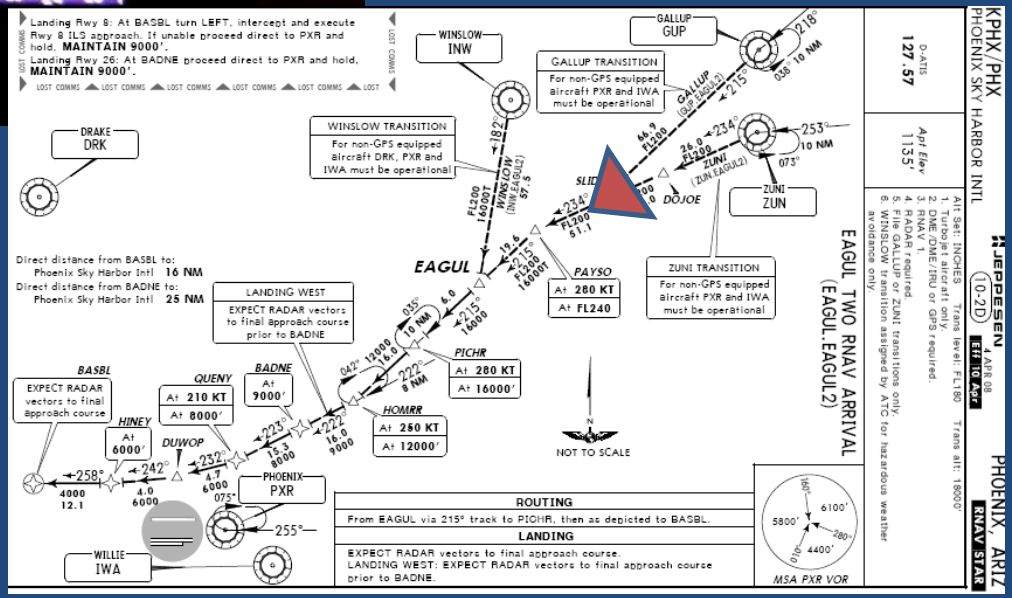
Persistence Pays

- Historically high fuel prices have heightened the urgency of optimizing our airspace where possible
- ABQ ARTCC began initiative to bring DV clearances back
- Since September 22, 2008
  - DV issued to all participating aircraft
  - Clearance issued at FL360; soon to go higher

Soaring Like An EAGUL

Snapshots of Descending Via

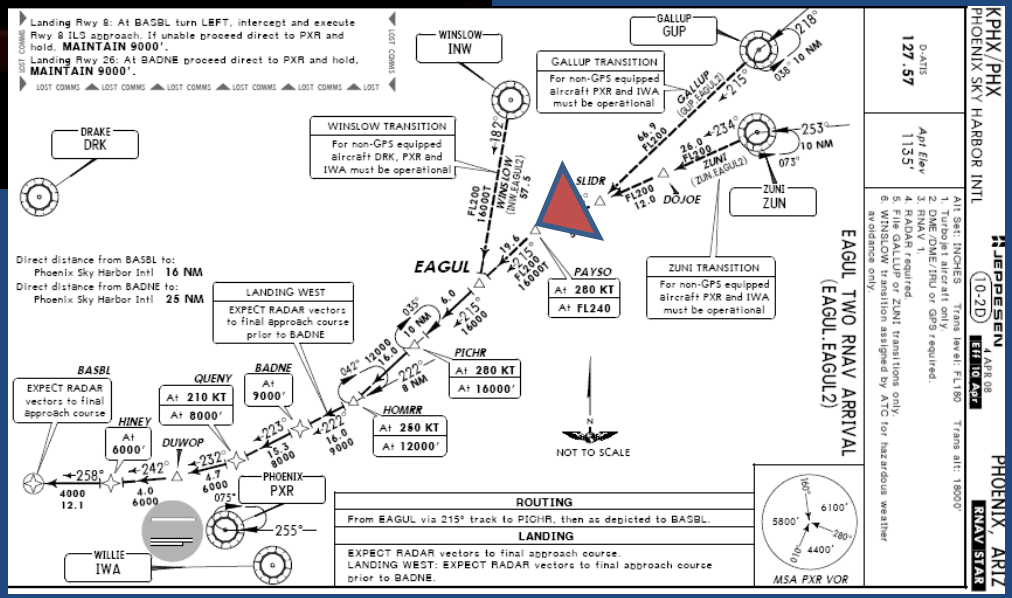

ILS APP
THR IDLE
DES
NAV
AP1
1FD2
A/THR
VOR1
41 NM


KPHX/PHX
PHOENIX SKY HARBOR INTL
JEPPESEN
(0-2D)
EFF 10 Apr
PHOENIX, ARIZ
RNAV STAR
EAGUL TWO RNAV ARRIVAL
(EAGUL.EAGUL2)
Landing Rwy 8: At BASBL turn LEFT, intercept and execute Rwy 8 ILS approach. If unable proceed direct to PXR and hold. MAINTAIN 9000'.
Landing Rwy 26: At BADNE proceed direct to PXR and hold. MAINTAIN 9000'.
LOST COMMS
WINSLOW
INW
GALLUP
GUP
GALLUP TRANSITION
For non-GPS equipped aircraft PXR and IWA must be operational
WINSLOW TRANSITION
For non-GPS equipped aircraft DRK, PXR and IWA must be operational
DRAKE
DRK
ZUNI
ZUN
ZUNI TRANSITION
For non-GPS equipped aircraft PXR and IWA must be operational
EAGUL
PAYSO
At 280 KT
At FL240
SLID
DOJOE
LANDING WEST
EXPECT RADAR vectors to final approach course prior to BADNE
Direct distance from BASBL to:
Phoenix Sky Harbor Intl 16 NM
Direct distance from BADNE to:
Phoenix Sky Harbor Intl 25 NM
BASBL
EXPECT RADAR vectors to final approach course
QUENY
At 210 KT
At 8000'
BADNE
At 9000'
PICHR
At 280 KT
At 16000'
HOMRR
At 280 KT
At 12000'
HINEY
At 6000'
DUWOP
PHOENIX
PXR
WILLIE
IWA
NOT TO SCALE
ROUTING
From EAGUL via 215° track to PICHR, then as depicted to BASBL.
LANDING
EXPECT RADAR vectors to final approach course.
LANDING WEST: EXPECT RADAR vectors to final approach course prior to BADNE.
MSA PXR VOR
6100'
5800'
4400'
D-ATIS
127.57
Apt Elev
1135'
Alt Set: INCHES
Trans level: FL180
Trans alt: 18000'
1. Turbojet aircraft only.
2. DME/DME/IRU or GPS required.
3. RNAV 1.
4. RADAR required.
5. File GALLUP or ZUNI transitions only.
6. WINSLOW transition assigned by ATC for hazardous weather avoidance only.

Flight Idle


EPR
CL
1.478
F.F LBS/H
600
600
FOB: 19960 LBS
EGT
°C
290
290
N1
%
47.3
47.3
N2
%
70.1
70.1
SEAT BELTS
NO SMOKING
LDG GEAR
AUTO BRK
LO
MED


ILS APP
THR IDLE
OES
ALT
NAV
AP1
1FD2
A/THR
320
300
280
260
240
FL 60
.69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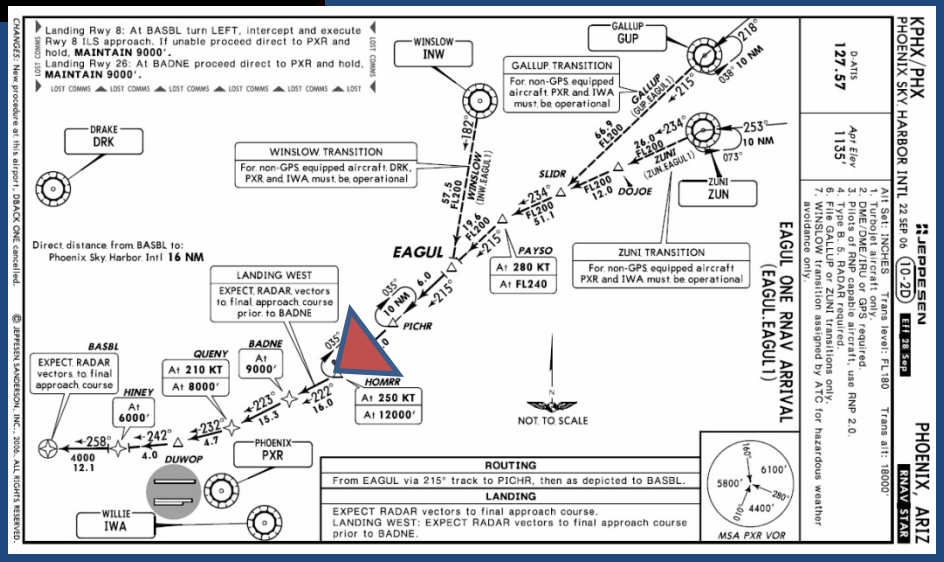
Landing Rwy 26: At BADNE proceed direct to PXR and hold. MAINTAIN 9000'.
Direct distance from BASBL to: Phoenix Sky Harbor Intl 16 NM
Direct distance from BADNE to: Phoenix Sky Harbor Intl 25 NM
Alt Set: INCHES. Trans level: FL180. Trans alt: 18000'
1. Turbojet aircraft only.
2. DME/DME/IRU or GPS required.
3. RNAV 1.
4. RADAR required.
5. File GALLUP or ZUNI transitions only.
6. WINSLOW transition assigned by ATC for hazardous weather avoidance only.

Maintaining Idle Descent


ILS APP
SPEED
ALT
DES
NAV
AP1
1FD2
A/THR
VOR1
30 NM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RNAV STAR
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A↓ 280 KT
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5800'
4400'
D-ATIS 127.57
Apt Elev 1135'
Trans alt: 18000'
Trans level: FL180
1. Turbojet aircraft only.
2. DME/DME/IRU or GPS required.
3. Pilots of RNP capable aircraft, use RNP 2.0.
4. Procedure NA when PXR NOTAM'd out.
5. Fly GALLUP or ZUNI transitions only.
6. File GALLUP or ZUNI transitions only.
7. WINSLOW transition assigned by ATC for hazardous weather avoidance only.
CHANGES: New procedure at this airport. DRACK ONE cancelled.
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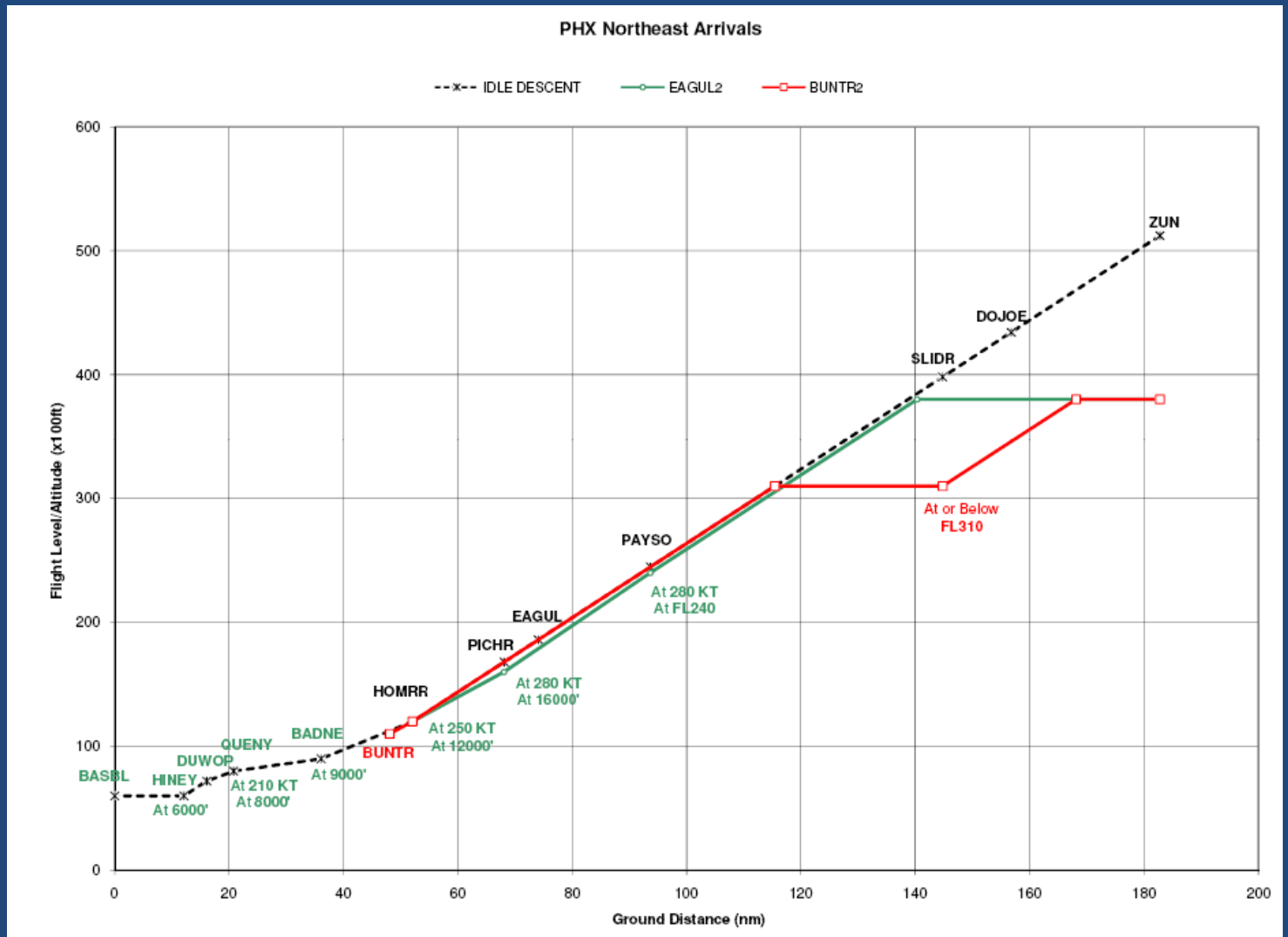
Slight power increase

EAGUL Enroute Profile

- Enroute Profile produces savings of
  - 3 gallons per flight
  - over $500,000 annually for arrivals into PHX @ $2.50/gal. *US Airways performance analysis based on charted procedure*

Or does it?

Comparing Profiles



Quantifying Conventional Profiles

- Challenging
  - Altitudes are “Expect” altitudes
  - Controller may “step down” causing “level offs”
  - Speed variations if no charted speeds
  - Profiles will vary
    - Some pilots will stay higher longer
    - Some will start down early, affecting compression
  - Increased need for off route vectors
- The unpredictability is difficult to measure

Capturing the Data

- MITRE Analysis
  - Using actual Conventional and RNAV profiles
  - Snapshot of the realistic savings
  - Awaiting the release of en route descent analysis

Looking Ahead

- ZAB continues to explore enhancements to all PHX STARs
  - Adjustments to published speeds
  - Adding additional constraint waypoints to reduce controller workload and provide consistency
  - Publishing altitudes on existing conventional STAR

Thank You!

Questions?

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